REPLACEMENT PAGES 26-31 ACCOMPANYING RESPONSE TO FINAL OFFICE ACTION FOR USSN 09/553,108

aromatics/PNA criteria, the preferred products have S levels less than about 100 wppm and a T10 point of >205 °C.

By using the diesel fuel compositions of the present invention, the level of the pollutants NOx and particulate matter is reduced to values which comply with current and projected levels specified in environmental legislation, i.e. NOx below 0.5g/Km and particulate matter below 0.05g/Km. These values/levels are significantly lower than that for comparable fuels in which the aromatic content split (i.e. the total aromatics to PNA ratio) falls outside the ranges of the present invention as shown in the examples below.

The present invention is further illustrated with reference to the Examples set forth in Table 4 below.

The following data was generated from two distillate fuels. The first one, Example 6, was prepared in a commercial hydrodesulfurization unit from a virgin distillate feed using a conventional $CoMo/Al_2O_3$ catalyst and represents a typical commercial diesel fuel composition. The second one, Example 7, is a composition according to the present invention, as set forth in Table 1. The properties of these two fuels are shown in Table 4 below.

Table 4

	Example 6	**Example 7**
Sulfur (wppm)	400	61
Mono-aromatics (% wt)	19.26	21.38
Polynuclear aromatics (% wt)	4.84	1.74
Total aromatics (% wt)	24.10	23.12
Aromatics/PNAs	5.0	13.3

Density (kg/m^3)	844.1	838.8
Cetane No.	55.8	56.5
T_{95} (°C)	337.0	335.1

These fuels were run in a fleet of 3 light-duty diesel vehicles encompassing traditional and modern technology, i.e., one with distributor pump technology, one with common rail fuel injection technology and one with electronic unit injector technology. Each fuel was tested three times in each vehicle (a total of nine tests per fuel) comprising a cold-start legislated European type certification drive cycle (ECE + EUDC) in order to determine average particulate emissions and average NOx emissions for both fuels. These average values were then compared to the predicted values for both fuels in accordance with the European Programme on Emissions, Fuel and Engine (EPEFE) technologies and the AutoOil equation for the effect of sulfur to determine the expected performance of the fuels now used. The EPEFE program is based on an established set of equations from testing of 11 diesel fuels in 19 vehicles to predict the emissions performance of a fleet of vehicles based upon the fuel parameters: cetane No., density and polycyclic aromatic content. On the basis of the differences in fuel parameters between Example 6 and Example 7, the EPEFE calculations would lead one to expect lower particulate matter and NOx emissions for the fuel of Example 7.

The results shown in Table 5 below show the average difference between the predicted reduction in emissions obtained from the EPEFE calculations and the observed reduction in average emissions for the fuel of Example 7 vs the fuel of Example 6. Surprisingly, the data indicate that the reduction in NOx and particulate matter emissions achieved using the fuel compositions of the present invention (Example 7) were substantially greater than that predicted for any of the 19 vehicles used in the EPEFE program as well as being significantly lower than the EPEFE

fleet average. In table 5, as in table 7 below, negative percentages indicate an emissions perfomance improvement.

Table 5. EPEFE/AutoOil predictions and actual fleet measurements for Example 7 emissions vs. Example 6 emissions(%)

EPEFE Vehicle	PM	NOx
1	-5.8	-0.1
2	-7.5	-0.9
3		0.0
4	-5.6	
5	-3.3	-1.7
6		-2.5
7	-4.9	-1.8
8	-6.7	-1.7
9	-2.8	-1.6
10	-3.7	-0.8
11	-6.2	0.2
12	-9.5	-1.5
13	-12.0	-1.5
14	-5.0	0.0
15	-1.8	0.7
16	-7.5	-2.5
17	-7.3	-0.9
18	-4.0	-0.1
19	-5.4	-2.0
EPEFE fleet prediction	**-10.94**	**-1.59**
Actual result from car tests	**-17.44**	**-4.50**

The fuel of Example 6 was also compared to another fuel of the present invention, Example 8. Table 6 below shows the properties of these fuels.

Table 6

	Example 6	Example 8
Sulfur (wppm)	400	14
Mono-aromatics (% wt)	19.26	20.09
Polynuclear aromatics (% wt)	4.84	1.19
Total aromatics (% wt)	24.10	21.28
Aromatics/PNAs	5.0	17.9
Density (kg/m^3)	844.1	843.0
Cetane No.	55.8	56.8
T_{95} (°C)	337.0	336.9

The fuels were run in a single light-duty diesel vehicle with common rail fuel injection technology. Each fuel was tested 3 times, where a test constituted a cold-start legislated European type certification drive cycle (ECE+EUDC). The relative emissions levels achieved from the Example 8 fuel tests (relative to Example 6) were evaluated and compared with established EPEFE and AutoOil predictions, as in the comparison between the fuels of Examples 7 and 6. The results, shown in Table 7 below, indicate that for average particulate matter and NOx emissions the reduction achieved for the fuel of Example 8 was unexpected as it was greater than that predicted for any of the 19 vehicles used in the EPEFE program, as well as being significantly lower than the EPEFE fleet average.

Table 7. EPEFE / AutoOil predictions and actual fleet measurements for Example 8 emissions relative to Example 6 emissions (%)

EPEFE Vehicle	**PM**	**NOx**
1	-4.9	1.0
2	-5.7	0.0
3	[illegible]	-0.1
4	-2.5	[illegible]
5	-1.8	-1.7
6	[illegible]	-2.6
7	-2.9	-2.1
8	-3.1	-0.7
9	-0.5	-2.0
10	2.3	-4.5
11	-1.8	-2.5
12	-6.3	-1.1
13	-8.7	-2.0
14	-1.7	-1.5
15	-0.9	-0.8
16	-7.1	-4.3
17	-6.1	-1.9
18	0.8	-1.2
19	-0.8	-3.5
EPEFE fleet Prediction	**-3.56**	**-1.13**
Actual result of car tests	**-20.51**	**-7.96**